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1.0 PURPOSE AND SCOPE

(5.1.1, 5.1.3.a, 5.1.3.b, 5.1.3.c, 5.1.3.d, 5.1.3.e, 5.1.3.f, 5.1.3.g, 5.1.3..h, 5.1.3.i, 5.1.3.j, 5.1.3.k, 5.1.3.l, 5.1.3.m, 5.1.4.a, 5.1.4.b, 5.1.4.c, 5.1.4.d, 5.1.4.e, 5.1.4.f, 5.1.4.g, 5.1.4.h, 5.1.4.i, 5.1.4.j, 5.1.4.k, 5.1.4.l, 5.1.4.m, 5.1.5, 5.1.7, 5.1.8.a)

This standard is the foundation for the Tank Farm Contractor (TFC) electrical safety program and describes the standards for the following:

- Electrical safety training
- Electrical equipment requirements
- Installation/modification requirements
- Electrical safe work practices.

NOTE: The TFC electrical safety program has been developed to comply with DOE Order 440.1A, Attachment 2, "Contractor Requirements Document." This attachment requires compliance with the following established codes and standards:

- 29 CFR 1910, Subpart S
- 29 CFR 1926, Subpart K
- NFPA 70E
- NFPA 70
- Revised Code of Washington (RCW) Title 19.28, "BUSINESS REGULATINOS – MISCELLANEOUS – Electricians and Electrical Installations."
- Washington Administrative Code (WAC)
  - 296-46A, "Safety Standards – Installing Electrical Wires and Equipment – Administrative Rules."
  - 296-401B, "Certification of Competency for Journeyman Electricians."
- The consensus national standards referenced in any of the above documents.

This standard applies to all CH2M HILL Hanford Group, Inc. (CH2M HILL) and subcontractor employees. This standard does not apply to electrical transmission and distribution installations under the exclusive control of Electric Utilities.

2.0 IMPLEMENTATION

This standard is effective on the date shown in the header.

3.0 STANDARD

3.1 Management and Administration

1. The Safety and Health Program manager appoints the electrical safety program coordinator.

2. The electrical safety program coordinator administers the electrical safety program and serves as the primary point of contact for the Hanford Workplace Electrical Safety Board.

3. The TFC participates in the Hanford electrical safety program, which is a forum for discussion and resolution of issues related to safe electrical system design and installation and safe work practices.

4. The DOE manager for the Office of River Protection (or delegate) is the Authority Having Jurisdiction or the TFC electrical safety program.

5. TFC managers and supervisors have the responsibility to ensure the electrical safety training requirements specified in Section 3.2 are satisfied.

6. TFC managers, supervisors, project engineers, and system engineers have the responsibility to ensure electrical equipment requirements specified in Section 3.3 are satisfied.

7. TFC managers, supervisors, project engineers, and system engineers have the responsibility to ensure electrical installation/modification requirements specified in Section 3.4 are satisfied.

8. Managers, supervisors, and employees have the responsibility to ensure the electrical safe work practices specified in Section 3.5 are satisfied.

9. Managers, supervisors, and employees have the responsibility to ensure that the requirements specified in Section 3.7 are satisfied for drilling into walls, floors, or outdoor slabs, and excavations containing buried electrical cable.

10. Managers and supervisors have the responsibility to ensure that shift routines, inspections, or surveillances that require working within the limited, restricted, or prohibited approach space (e.g., removing/opening electrical covers, working near exposed energized parts) are conducted by personnel qualified to work within those spaces.

11. ESH&Q directors and the appropriate line management vice president have the responsibility to approve Energized Electrical Work Permits.

3.2 Electrical Safety Training

(5.1.6)

1. All employees must receive basic electrical safety training in the Hanford General Employee Training (HGET).

2. Non-electrical workers, such as painters, operators, health physics technicians, pipefitters, and carpenters, who face a higher than normal risk of exposure to energized electrical parts of 50 volts or more, must receive training course 044480, “OSHA Electrical Cord/ Power Tool Safety,” or an equivalent. Refresher training for course 044480 must be received at intervals not exceeding three years.

3. Electrical workers must receive training course 043870, “NFPA 70-E Standards for Electrical Safety,” or equivalent. Refresher training course for course 043870 must be received at intervals not exceeding three years.

4. Electricians must be trained in first aid, including basic first aid, cardiopulmonary resuscitation (CPR), and hazards and control measures for bloodborne pathogens. First aid refresher training must be received at intervals not exceeding two years (bloodborne pathogen training annually).

5. All employees who will work on deenergized electrical components being controlled by a lockout/tagout must be trained as an authorized worker in accordance with TFC-OPS-OPER-C-05.

6. First line managers, supervisors, and field work supervisors must receive the same level of Occupational Safety and Health Administration (OSHA)-based electrical safety training as the workers for whom they are responsible or for whom they plan or supervise work.

7. If the worker is unfamiliar with the construction or operation of equipment, or if the worker is unfamiliar with the hazards associated with a task, additional training or instruction must be provided. In these cases, the supervisor must document the instruction the worker has received, both in the use of safe work practices for the voltage levels to be encountered, and the selection, inspection, and use of personal protective equipment.

3.3 Electrical Equipment Requirements

1. All electrical equipment must be approved (acceptable to the authority having jurisdiction for enforcing the National Electric Code (NEC)). (The criterion for approving electrical equipment is that it must be listed or labeled by a nationally recognized testing laboratory such as the Underwriters' Laboratory.)

   NOTE: Nationally recognized testing laboratories are listed on the OSHA web site at http://www.osha-slc.gov/dts/otpca/nrtl/index.html. Nationally recognized testing laboratories listed on this site are certified only for certain products. It is the designer's responsibility to ensure the listing is appropriate for the equipment specified.

2. Equipment without a listing mark or label by a nationally recognized testing laboratory is not approved unless a nationally recognized testing laboratory category for that type of equipment does not exist. If a category for that equipment does not exist, the equipment can only be approved for use if accepted by one of the designated NEC inspectors.

3.4 Installation/Modification Requirements

1. All new electrical installations and modifications to existing electrical installations must be in compliance with the requirements of NFPA 70 (NEC). Installations and modifications that meet these criteria must be subject to inspection by an NEC inspector. NEC inspections must be performed by NEC inspectors designated by the Hanford Electrical Code Board as defined in TFC-PRJ-P-C-02.

2. All wiring on or within the premises of CH2M HILL-managed facilities or projects must be in compliance with the NEC and WAC 296-46. (Verification of compliance is accomplished by inspection of all new wiring and any modification to existing wiring by a designated NEC inspector.)

   NOTE 1: An Electrical Installation Permit is required to obtain an NEC inspection. Permits are required before the installation of any electrical equipment. The contractor performing the installation or modification to electrical equipment is responsible for obtaining an Electrical Installation Permit. Permits are available from any designated NEC inspector.

NOTE 2: Electrical installations that are part of a project having an acceptance inspection plan require an Electrical Installation Permit. The acceptance inspection plan must be referenced on the permit form in the area for NEC inspection hold points.

NOTE 3: Facilities installing new electrical equipment or modifying existing electrical systems may perform such work using an Annual Inspection Permit.

3. Ground fault circuit interrupters (GFCIs) must be installed as required by the NEC, including:

   - On 125 volt outside receptacles
   - Within six feet of a sink or an outside door
   - In damp or wet (standing water) work areas
   - On all 125 volt receptacles that are not part of the permanent structure wiring (including extension cords) and that are in use by personnel.

4. Temporary power receptacles that are not part of the permanent wiring of a building or structure (other than 120-volt, single-phase 15, 20, and 30 ampere, (i.e., 480-volt 3-phase)), portable electrical tools, cord sets, and cord-and plug-connected equipment required to be grounded that are not protected by a GFCI but are used by personnel, must be tested as follows:

   - Equipment grounding conductors are tested for continuity.

   - Receptacle and attachment plugs are tested for correct attachment of the equipment grounding conductor.

   - Tests are performed as follows:

     – Before first use on-site
     – When there is evidence of damage
     – Before equipment is returned to service following any repairs
     – At intervals not exceeding three months.

3.5 Electrical Safe Work Practices
(5.1.6)

When work is performed on or near equipment or circuits that are or may be energized, safety-related work practices must be employed to prevent electrical shock, flash burns, or other injuries resulting from either direct or indirect electrical contacts. Specific safety-related work practices must be consistent with the nature and extent of the associated hazards.

3.5.1 Using Electrical Protective Equipment

1. Non-conducting and insulating equipment must be used and stored according to the manufacturer’s instructions.

2. Class and type of protective equipment must be selected based on the maximum use voltages that may be encountered, the nature of the work to be performed, and the part(s) of the body potentially exposed.

3. Protective equipment must be visually or functionally inspected before use for damage and defective conditions that may affect insulating properties, e.g., rubber gloves are inspected for holes.

4. Protective equipment must be verified (before use) to have satisfied all required tests, e.g., rubber gloves have been air tested.

5. Protective equipment that has an expired testing date or fails visual or functional inspection must be removed from service.

   NOTE: Electrical protective equipment repair must be performed by qualified personnel.

6. Voltage rated tools must be inspected for defects and surface contamination, such as moisture or oil, before each use.

3.5.2 Using Electrical Test Equipment

1. All personnel who use electrical test equipment must be qualified by training and/or experience in the operation and limitation of the equipment.

2. Electrical test equipment must be visually inspected immediately before use. Defective test equipment must not be used, must be removed from service, and must be identified by tagging it out of service.

3. Electrical test equipment must only be used for its intended applications. Operating instructions and limitations for the test equipment must be available to the worker using the equipment.

4. Electrical test equipment used to verify that circuits are deenergized must be tested for proper operation before testing the deenergized circuit. In circuits over 600 volts, the test equipment must also be checked against a known source after the circuit test.

5. Zero-energy checks must be made after ensuring stored electrical or mechanical energy is not able to reenergize the circuit.

3.5.3 Using Ground Fault Circuit Interrupters

1. Permanently installed GFCIs must be tested monthly in accordance with the manufacturer's instructions.

2. GFCIs must be used when portable, electric hand tools are used outdoors or in damp and wet locations.

3. Portable, electric hand tools must be ensured to meet the requirements specified in HNF-IP-0842, Volume 9, Section 4.20.

4. Portable GFCIs must be tested before each use. The test sequence is as follows.

   - GFCI is visually inspected for obvious defects and broken parts. (Test is abandoned if the GFCI appears broken.)

- Test button is pressed to cause the GFCI to trip. (A "click" can be heard or felt when the GFCI trips.)
- A voltage meter or load device (e.g., trouble light) is used to verify zero voltage.
- Reset button is pressed and the restored power is verified.

5. GFCIs that fail to respond in the expected manner at any stage of the test must not be used and the supervisor must be informed of the failed test. (The supervisor has the responsibility to report failed test to the appropriate authority for troubleshooting and corrective actions.)

3.5.4 Using Flexible Cords and Cables

1. Flexible cords must not be used as a substitute for the permanent wiring of a building.

2. Flexible cords and extension cord sets must be approved (listed or labeled by a nationally recognized testing laboratory) and suitable for conditions of use.

3. Flexible cord and extension cord sets used with grounded equipment must contain an equipment-grounding conductor.

4. Flexible cords and cables must be protected from damage.

5. Extension cord sets, except those used with appliances that are for extended service and not exposed to damage, must be inspected daily and before use. (Cords and cables may be damaged by foot traffic, vehicles, sharp edges, pinching, improper storage, etc.).

6. Damaged extension cord sets or flexible cords must be discarded or repaired by a qualified person. Hard service flexible cords, No. 12 or larger, may be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.

7. The practice of plugging an extension cord into another extension cord (daisy chaining) is not permitted unless stated otherwise on the cord label by the manufacturer.

3.5.5 Using Deenergized Live, Exposed Parts

1. The requirements of the lockout/tagout program, as described in TFC-OPS-OPER-C-05, must be used for the control of unexpected releases of hazardous energy or materials.

2. Exposed electrical parts of equipment operating at 50 volts or more must be deenergized before any work is performed on or near these parts.

3. Stored energy, which might endanger personnel, must be released. Capacitors must only be discharged with a device intended for this use. High capacitance elements are short-circuited and protective grounds must be installed if the stored electrical energy has the potential to endanger personnel.

4. Field conditions and work instructions must be verified.

3.5.6 Deenergizing Without Lockout/Tagout

1. Equipment without a cord and plug and circuits capable of being energized must be treated as live if they are not locked out and tagged out in accordance with TFC-OPS-OPER-C-05.

2. Equipment with a cord and plug can be considered deenergized when the plug is under the direct control of the qualified person performing the work.

3.5.7 Conditions Under Which Deenergizing may not be Required

1. Work on or near an exposed energized circuit is only permitted if deenergizing the circuit introduces additional or increased hazards, or is not feasible due to equipment design or operational limitations. Examples of increased or additional hazards include interruption of life support systems, deactivation of emergency alarms, shutdown of hazardous location ventilation equipment, or removal of illumination for an area.

   Examples of work that can be performed on or near energized circuit parts include the following:

   - Testing of electrical circuits that can only be performed with the circuit energized
   - Work on circuits that form an integral part of a continuous industrial process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

2. Energized parts that operate at less than 50 volts potential do not need to be deenergized if there will be no increased exposure to electrical burns or to explosions due to electrical arcs and the voltage is verified by documented voltage checks prior to commencing work.

3. Except for the following conditions, an Energized Electrical Work Permit must be included in the work plan/package for all work within the restricted approach boundary of electrically energized parts when it has been determined by the facility Operations manager that deenergizing will introduce additional risk or is not feasible:

   - Performing zero-energy checks for lockout/tagout operations
   - Installing safety barriers where the risk of electrical shock or burn is unlikely
   - Performing testing and troubleshooting that requires the circuit to be energized
   - Working on energized parts that operate at less than 50 volts potential.

   NOTE: Only the appropriate ESH&Q directors and the appropriate line management vice president have the responsibility to approve Energized Electrical Work Permits.

3.5.8 Testing and Troubleshooting on Live, Energized Parts

1. Testing and troubleshooting on energized parts is only permitted when the circuit must be energized to perform the task (e.g., voltage checks).

   NOTE: If a problem is discovered during the troubleshooting, and repairs are to be initiated; the requirements for deenergizing the circuit must be followed before repair work begins.

2. Pre-job planning for electrical troubleshooting must establish a scope of work, identify known and potential hazards, and include all required personal protective equipment, insulated tools, and the protective measures and equipment to be employed. The procedure for pre-job planning is TFC-ESHQ-S_SAF-C-02.

   NOTE: Troubleshooting energized electrical circuits and equipment can vary from simple, routine voltage checks, to complex measurements with sophisticated test equipment. Some troubleshooting tasks can begin as low risk, routine jobs, and then become more complex and hazardous as the work progresses.

3.5.9 Working on or Near Exposed Energized Parts

1. Electrical arc hazards must be considered in pre-job planning for work within the limited approach boundaries. An appropriate engineering arc flash or fault current hazard analysis must serve as the basis for determining the protective measures necessary to ensure worker safety. A flash protection boundary must be established based on the engineering analysis and the approach boundaries listed in Table 1.

   The default flash protection boundary for systems operating at 600 volts and below must be four feet. A flash protection boundary less than four feet may be established under engineering supervision. The basis for establishing a flash protection boundary less than four feet must be documented.

2. Appropriate flame resistant personal protective equipment must be determined, documented in a job hazards analysis, and worn by the workers in the flash protection boundary in accordance with NFPA 70E, Chapter 3, “Personal and Other Protective Equipment.”

   NOTE: NFPA 70E, Part II, Appendix B, contains information, sample flash calculations, and formulae for establishing the flash protection boundary.

3.5.10 Working Within the Limited Space for Exposed, Energized Electrical Parts
(5.1.8.b)

1. Personnel working within the limited, restricted, or prohibited approach space must be qualified to work within those spaces. Table 1 lists the approach distance to exposed energized electrical conductors and circuit parts.

2. An unqualified person must be accompanied by a qualified person when entering a limited space. The accompanying qualified person must advise the unqualified person of the possible hazards and ensure the unqualified person is safeguarded.

3. Requirements for qualified personnel entering a limited space are:

   - Specific knowledge of equipment
   - Determination of the personal protective equipment required for the task to be performed
   - Wearing the required personal protective equipment during the performance of the task.

4. If a worker receives an electrical shock (other than static), work must be stopped, the worker must report to an appropriate first aid station, and the incident must be reported to management.

5. Signs (designed in accordance with 29 CFR 1910.145), barricades, or attendants must be used to isolate the work area and warn others of the exposed energized electrical circuits. Electrical safety warning signs are worded as follows:

   DANGER – ELECTRICAL HAZARDS -
   AUTHORIZED PERSONNEL ONLY

3.5.11 Working Within the Restricted Space for Exposed, Energized Electrical Parts
(5.1.2.a)

1. Electrical equipment must be deenergized to the maximum extent feasible before crossing the restricted approach boundary to perform work on the equipment.

2. Entry into a restricted space by a qualified worker requires the following:

   - Documented plan, including required personal protective equipment, insulated tools, etc
   - Approval of the plan from the facility Operations manager, a company industrial safety representative, and the worker's direct supervisor
   - An Energized Electrical Work Permit if the work is within the restricted approach boundary, except when:
     - Performing zero-energy checks for lockout/tagout operations
     - Installing safety barriers where the risk of electrical shock or burn is unlikely
     - Performing testing and troubleshooting that require the circuit to be energized
     - Working energized parts that operate at less than 50 volts potential.

3. Energized distribution panels operating at 240 volts and below may have covers removed and replaced for observation purposes only. Voltage-rated gloves must be worn by qualified workers while handling panels. A barricade or attendant must be used to provide the protection necessary to prevent unauthorized personnel from entering into the space while the cover is removed.

4. The electrical worker performing the task and their manager/supervisor must review the hazards involved and determine the appropriate personal protective equipment for the task.

   NOTE: Since each job may differ in electrical hazards, personal protective equipment also varies according to the job. Personal protective equipment may include flame resistant clothing, voltage-rated rubber blankets, gloves, pads, insulated tools, or

insulated protective barriers that provide protection that is at least equivalent to that from ANSI qualified materials.

5. Conductive accessories such as rings, watches, bracelets, metal frame glasses, metal hats, etc., must not be worn where they present an electrical contact hazard with exposed energized conductors or circuit parts unless they are rendered non-conductive by covering, wrapping, or other insulation.

3.5.12 Resetting Tripped Protective Devices

NOTE: Electrical protective devices may be, but are not limited to, fuses, circuit breakers, or equipment protective devices (e.g., motor thermal units, government-furnished property, etc.).

1. After a circuit is deenergized by a protective device, the circuit must not be manually reenergized until it has been determined that the equipment and circuit can be safely reenergized.

2. Electrical protective devices must be reset in the following sequence:

   a. The cause of the trip is investigated by an electrician with proper troubleshooting techniques and test equipment to determine what condition occurred and that the equipment and circuit may be safely reenergized.

   b. The electrical protective device is reset or replaced if the device is a fuse.

   NOTE: All 120 VAC, single-pole GFCIs that trip during use may be reset one time without completing the above sequence.

3.5.13 Performing Work Affecting Electrical Utilities

1. Electrical Utilities must be consulted as soon as practical when planning work that may affect their equipment or facilities.

2. It is not permitted to come closer than ten feet, including the length of conductive equipment, to overhead high voltage lines with voltages 50 kilovolts to ground or below. If a vehicle is in transit with its structure lowered, the clearance may be reduced to four feet. For voltages to ground over 50 kilovolts, four inches are added for every 10 kilovolts over 50 kilovolts.

3. Electrical Utilities must be notified at least 48 hours before performing any of the following operations or activities:

   - Moving any equipment taller than fourteen feet under overhead power lines

   - Operating equipment within twenty horizontal feet from overhead high-voltage (over 600 V) power lines.

   NOTE: The electrical dispatcher is located at 251-W Building. The electrical dispatcher may be reached at 373-2321 (see “Electrical Dispatcher” in the Hanford Yellow Pages).

NOTE: Requirements for operating cranes are described in DOE-RL-92-36, "Hanford Site Hoisting and Rigging Manual," 14.4.7, "Operating Cranes Near Energized Transmitters or Electrical Power Lines."

3.6 Energized Electrical Work Permit
(5.1.6)

1. The Energized Electrical Work Permit (A-6001-687) requires approval by the appropriate line management vice president, the appropriate ESH&Q directors, and the worker's direct supervisor for any work within the restricted or prohibited approach boundary, except as stated below:

   - Performing zero-energy checks for lockout/tagout operations
   - Installing safety barriers where the risk of electrical shock or burn is unlikely
   - Performing testing and troubleshooting that requires the circuit to be energized
   - Working energized parts that operate at less than 50 volts potential.

2. Energized distribution panels operating at 240 volts and below may have covers removed and replaced for observation purposes only. Voltage-rated gloves must be worn by qualified workers while handling panels. A barricade or attendant must be used to provide the protection necessary to prevent unauthorized personnel from entering into the space while the cover is removed.

3.7 Drilling into Walls, Floors, or Outdoor Slabs and Excavations Containing Buried Electrical Cables

NOTE: TFC-ESHQ-S_IS-C-03 describes the procedure for excavating, trenching, and shoring.

1. Managers, supervisors, and employees have the responsibility to ensure that the requirements specified in this are satisfied for drilling into walls, floor, or outdoor slabs and excavations containing buried electrical cable.

2. A documented plan for drilling into walls, floors, or outdoor slabs and excavations where buried electrical cables could be located must be completed before work commences.

3. All pertinent drawings and documentation must be reviewed. Before the job is started, the job site must be reviewed to determine if obstructions are in the drilling or excavating path.

4. Electrical circuits or conductors in the drilling or excavating path must be deenergized to the maximum extent feasible before the job is started.

5. If it has been determined by the facility Operations manager that deenergizing will introduce additional risk or is not feasible, justification for not deenergizing the electrical circuits or conductors in the drilling or excavating path must be entered in the work plan/ package by the facility Operations manager prior to starting the job.

6. If the presence and location of electrical circuits or conductors cannot be accurately identified and deenergized, appropriate mitigating controls must be used. At a minimum, workers doing blind penetrations must use appropriate voltage-rated gloves with protective outer leather gloves and non-conductive safety glasses with side shields

7. Suspected cable locations must be periodically verified with hand-held detection equipment or other acceptable means of locating utility installations.

3.8 Shift Routines, Inspections, and Surveillances

Managers and supervisors have the responsibility to ensure that shift routines, inspections, or surveillances that require working within the limited, restricted, or prohibited approach space (e.g., removing/opening electrical covers, working near exposed energized parts) are conducted by personnel qualified to work within those spaces.

NOTE: An unqualified person may enter the limited space when accompanied by a qualified person. The accompanying qualified person shall advise the unqualified person of the possible hazards and ensure the unqualified person is safeguarded.

4.0 DEFINITIONS

Authority Having Jurisdiction. A person knowledgeable in the requirements of NFPA 70, NFPA 70E, 29 CFR 1910, Subpart S, and 29 CFR 1926, Subpart K, and assigned to interpret and enforce these electrical safety requirements on the Hanford Site.

Designated National Electrical Code inspector. A National Electrical Code (NEC) inspector designated by the Hanford Electrical Code Board and who represents the NEC authority having jurisdiction.

Electrical Energized Work Permit. The standard method used to document a work plan used before performing energized electrical work as recommended by NFPA 70E, Part II, Appendix A-1-2.4.

Exposed parts (as applied to live parts). Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated.

Ground fault circuit interrupter. A device whose function is to interrupt the electric current to the load when a fault current to ground exceeds some pre-determined value that is less than that required to operate the overcurrent protective device of the supply circuit.

Hanford Electrical Code Board. A board whose members are subject matter experts in electrical design and installation and in related codes, most notably the NEC. Members are appointed by participating Hanford contractors. The board provides accurate and consistent interpretation of the NEC and advice to the authority having jurisdiction on matters pertaining to the NEC.

Hanford electrical safety program. Established with collaboration between DOE RL and ORP to ensure consistency in the interpretation and implementation of electrical safety codes and electrical safety work practices. Consisting of two technical boards -- the Hanford Electrical Code Board (HECB) and the Hanford Workplace Electrical Safety Board (HWESB).

Hanford Workplace Electrical Safety Board. A board whose members are subject-matter experts in electrical safety and in related codes, most notably the NFPA 70E, “Standard for Electrical Safety Requirements for Employee Workplaces.” The board provides accurate and consistent interpretation of OSHA 1910, Subpart S, 1926 Subpart K, and NFPA 70E on matters pertaining to the worker electrical safety requirements at the Hanford Site.

Qualified person. One who is trained and knowledgeable of the construction and operation of equipment or a specific work method and is trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method.

Troubleshooting and testing. Actions necessary to measure voltage and current and to verify the operability of equipment without repairing or replacing components.

Working near. Any activity inside the limited approach boundary of exposed energized electrical conductors or circuit parts that are not put into an electrically safe work condition.

Working on. Coming in contact with exposed energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing.

5.0 SOURCES

5.1 Requirements

1. DOE Order 4401.A, "Worker Protection Management for DOE Federal and Contractor Employees, Attachment 2, Contractor Requirements Document." (S/RID)

2. 29 CFR 1910, Subpart I, "Personal Protective Equipment." (S/RID)
   a. 1910.137, "Electrical Protective Devices."

3. 29 CFR 1910, Subpart S, "Electrical." (S/RID)
   a. 1910.302, "Electric utilization systems."
   b. 1910.303, "General requirements."
   c. 1910.304, "Wiring design and protection."
   d. 1910.305, "Wiring methods, components, and equipment for general use."
   e. 1910.306, "Specific purpose equipment and installations."
   f. 1910.307, "Hazardous (classified) locations."
   g. 1910.308, "Special systems."
   h. 1910.331, "Scope."
   i. 1910.332, "Training."
   j. 1910.333, "Selection and use of work practices."
   k. 1910.334, "Use of equipment."
   l. 1910.335, "Safeguards for personnel protection."
   m. 1910.399, "Definitions applicable to this subpart."

4. 29 CFR 1926, Subpart K, "Electrical." (S/RID)
   a. 1926.402, "Applicability."
   b. 1926.403, "General requirements."
   c. 1926.404, "Wiring design and protection."
   d. 1926.405, "Wiring methods, components, and equipment for general use."
   e. 1926.406, "Specific purpose equipment and installations."
   f. 1926.407, "Hazardous (classified) locations."
   g. 1926.408, "Special systems."
   h. 1926.416, "General requirements."
   i. 1926.417, "Lockout and tagging of circuits."
   j. 1926.431, "Maintenance of equipment."
   k. 1926.432, "Environmental deterioration of equipment."
   l. 1926.441, "Batteries and battery charging."

m. 1926.449, “Definitions applicable to this subpart.”

5. NFPA 70, “National Electrical Code (NEC).”

6. NFPA 70E, “Standard for Electrical Safety Requirements fort Employee Workplace.”

7. Revised Code of Washington (RCW) Title 19.28 “BUSINESS REGULATIONS - MISCELLANEOUS - Electricians and Electrical Installations.”

8. Washington Administrative Code (WAC).
   a. 296-46A, “Safety Standards - Installing Electrical Wires and Equipment - Administrative Rules.”
   b. 296-401B, “Certification of Competency for Journeyman Electricians.”

5.2 References

1. DOE-HDBK-1092-98, DOE Handbook, “Electrical Safety.”

2. HNF-IP-0842, RPP Administration, Volume 9, Section 4.20, “Hand and Portable Power Tools.

3. HNF-RD-11827, “Hanford Electrical Safety Program Requirements.” (NOTE: For operation of the Hanford Workplace Electrical Safety Committee and Hanford Electrical Code Board.)

4. TFC-ESHQ-S_IS-C-03, “Excavating, Trenching, and Shoring.”

5. TFC-ESHQ-S_SAF-C-02, “Job Hazard Analysis.”

6. TFC-OPS-OPER-C-05, “Lockout/Tagout Program.”

7. TFC-PRJ-P-C-02, “NEC Compliance Inspection.”

Table 1. Approach Distance to Exposed Energized Electrical Conductors and Circuit Parts. (Adapted from NFPA 70E, 2000 Edition, Table 2-1.3.4)

Nominal System Voltage Range	Limited Approach Boundary		Restricted Approach Boundary	Prohibited Approach Boundary
Phase to Phase	Exposed Movable Conductor	Exposed Fixed Circuit Part	Includes Inadvertent Movement Adder	
Less than 300 V	10 ft. 0 in.	3 ft. 6 in.	1 ft. 0 in.	AVOID CONTACT
300 V to 750 V	10 ft. 0 in.	3 ft. 6 in.	1 ft. 0 in.	1 in.
Over 750 V, not over 15 kV	10 ft. 0 in.	5 ft. 0 in.	2 ft. 2 in.	7 in.
Over 15 kV, not over 36 kV	10 ft. 0 in.	6 ft. 0 in.	2 ft. 7 in.	10 in.

NOTE 1: When assessing distance, include the length of any conductive tools being used to perform work.

NOTE 2: The default flash protection boundary for systems operating at 600 volts and below is four feet. A flash protection boundary less than four feet may be established under engineering supervision. The basis for establishing a flash protection boundary less than four feet shall be documented. NFPA 70E, Part II, Appendix B, contains information, sample flash calculations, and formulae for establishing the flash protection boundary.